

CHAPTER 2

UNDERGRADUATE DEGREES

Overview

Analyzing historical trends on the participation of women and minorities in science and engineering education helps in understanding their current rates of participation in science and engineering employment. Currently employed scientists and engineers include recent degree recipients as well as those who earned degrees 40 to 50 years ago. Although comparable data on science and engineering degrees are not available 40 to 50 years back, data on science and engineering bachelor's, master's, and doctoral degrees to women are available from 1966 to 1996. For racial/ethnic groups, comparable data are available only from 1985, and comparable annual data are available only from 1989. Even with these limited time series, though, it is possible to see the extremely small percentages of women and minorities earning degrees in science and engineering in years past. However, both the numbers and percentages of women and minorities earning science and engineering degrees at all levels (associate's, bachelor's, master's and doctorate) have increased over time.

Associate's degrees

About half of entering undergraduate students are seeking either an associate's degree or a certificate. After 5 years, however, only 24 percent have actually earned such a degree or a higher level degree (NCES 1998b). In all, only 13 percent of associate's degrees are awarded in science and engineering. Although associate's degrees are the terminal degree for some, others continue their education and subsequently earn higher degrees. About 13 percent of 1995 and 1996 science and engineering bachelor's degree recipients had previously earned associate's degrees. (See text table 2-1.)

Women

The number of associate's degrees in science and engineering awarded to women rose from 18,282 in 1983 to 21,070 in 1996; concurrently, the number awarded to

men dropped from 61,218 to 46,750. (See appendix table 2-1.) Women earned 31 percent of the associate's degrees in science and engineering in 1996, up from 23 percent in 1983. In 1996, they earned at least 45 percent of the associate's degrees awarded in computer science, biological sciences, physical sciences, psychology, social sciences, and interdisciplinary sciences, but only 13 percent of those in engineering and 14 percent in engineering technologies. The largest increases from 1983 to 1996 in the numbers of associate's degrees awarded to women were in biological sciences, psychology, social sciences, and interdisciplinary or other sciences. (See appendix table 2-1.)

The largest numbers of science and engineering associate's degrees are awarded in computer science and engineering technologies. From 1983 to 1996, the number

Text table 2-1.

Percentage of academic year 1995 and 1996 science and engineering bachelor's graduates who had previously earned associate's degrees, by sex, race/ethnicity, and disability status: 1997

Total.....	13.2
Women.....	13.7
Men.....	12.7
White, non-Hispanic.....	13.4
Asian/Pacific Islander.....	11.5
Black, non-Hispanic.....	11.2
Hispanic.....	14.5
American Indian/Alaskan Native.....	19.7
Persons without disabilities.....	12.8
Persons with disabilities.....	23.3

NOTE: The only statistically significant difference between groups is for persons with and without disabilities.

SOURCE: National Science Foundation, Survey of Recent College Graduates, 1997.

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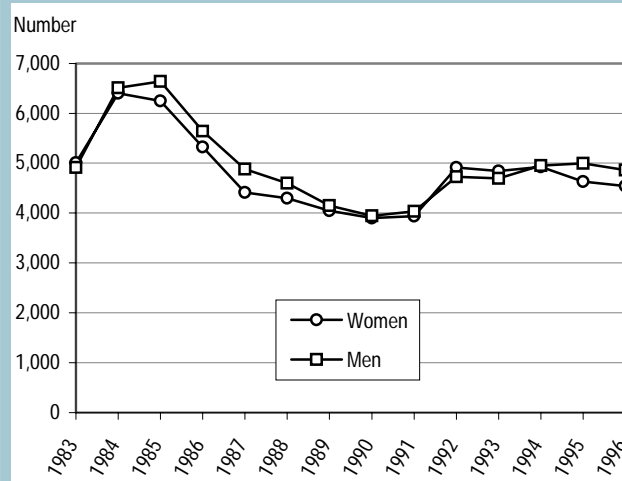
of associate's degrees in computer science awarded to women and men followed similar patterns. (See figure 2-1.) Associate's degrees in engineering technologies decreased for men but increased slightly for women in 1996.

Minorities¹

In 1996, blacks earned 9 percent of the associate's degrees awarded in science and engineering, Hispanics earned 8 percent, Asians 5 percent, and American Indians 1 percent; in contrast, whites earned 73 percent. (See text table 2-2.) Hispanics and American Indians, as noted in chapter 1, are more likely than other groups to enroll in 2-year colleges.

The number of associate's degrees in science and engineering increased for Asian, black, and American Indian students and decreased for white and Hispanic students from 1995 to 1996. (See appendix table 2-2.) The number of associate's degrees in computer science increased for blacks and American Indians and decreased

Figure 2-1.
Associate's degrees in computer science, by sex: 1983-96



SOURCE: Tabulations by National Science Foundation/Division of Science Resources Studies; data from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey.

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¹ Data refer to U.S. citizens and permanent residents only.

Text table 2-2.

Percentage distribution of associate's degrees, by race/ethnicity and field: 1996

Field	Total	U.S. citizens and permanent residents						Nonresident aliens
		White, non-Hispanic	Asian/Pacific Islander	Black, non-Hispanic	Hispanic	American Indian/Alaskan Native	Other/unknown	
All fields.....	100.0	74.6	4.2	9.1	7.2	1.0	2.1	1.9
Science and engineering, total.....	100.0	73.1	4.9	9.0	8.2	1.2	1.9	1.7
Mathematics.....	100.0	57.9	13.6	4.7	14.2	1.2	2.0	6.3
Computer science.....	100.0	66.3	5.6	11.8	10.0	1.4	2.3	2.6
Physical sciences.....	100.0	65.5	10.1	6.5	6.8	1.7	4.1	0.1
Earth, atmospheric, and ocean sciences.....	100.0	84.6	4.1	5.6	1.5	0.0	2.6	1.5
Agricultural sciences.....	100.0	90.7	0.3	0.9	3.9	2.1	1.2	0.8
Biological sciences.....	100.0	65.4	10.4	5.5	10.7	2.0	3.1	2.9
Psychology.....	100.0	69.1	3.6	9.3	11.3	2.7	2.1	2.0
Social sciences.....	100.0	59.1	6.3	11.0	13.2	3.8	2.7	3.9
Engineering.....	100.0	73.1	7.2	6.6	6.5	0.5	2.6	3.4
Science technologies.....	100.0	72.8	6.2	11.1	5.8	0.2	2.9	1.0
Engineering technologies.....	100.0	75.8	4.1	8.6	7.9	0.7	1.9	1.0
Other science and engineering technologies.....	100.0	82.2	4.0	13.5	0.2	0.2	0.0	0.0
Interdisciplinary or other sciences.....	100.0	76.6	4.6	10.4	6.0	0.8	0.5	1.0

SOURCE: Tabulations by National Science Foundation/Division of Science Resources Studies; data from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey.

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for all other racial/ethnic groups in 1996. The number of associate's degrees in engineering technologies decreased for all racial/ethnic groups in 1996.

Minority women

In 1996, minority women earned a larger proportion of associate's degrees in science and engineering awarded to their respective racial/ethnic groups than did white women. Women earned 48 percent of the science and engineering associate's degrees awarded to American Indians, 38 percent of those to blacks, 34 percent of those to Hispanics, and 33 percent of those to Asians. (See appendix table 2-3.) In contrast, women earned only 29 percent of the science and engineering associate's degrees awarded to whites.

In many fields, women earned well over half of the associate's degrees in science and engineering awarded to their respective racial/ethnic group. In each racial/ethnic group, women earned more than half of the associate's degrees in the biological sciences, psychology, and the social sciences. In the physical sciences, black, American Indian, and Asian women earned half of the associate's degrees awarded to their racial/ethnic groups. In computer science, women earned more than half of the associate's degrees awarded to blacks, Hispanics, and American Indians.

Persons with disabilities

As noted in the previous chapter, students with disabilities are more likely to enroll in 2-year colleges than those without disabilities. Similarly, persons with disabilities are more likely than those without to earn associate's degrees prior to earning a bachelor's degree. Among 1995 and 1996 science and engineering bachelor's degree recipients, 23 percent of persons with disabilities, compared with 13 percent of those without disabilities, had previously earned associate's degrees. (See text table 2-1.)

Bachelor's degrees

Bachelor's degrees are the most prevalent degree in science and engineering, accounting for more than three-quarters of all degrees awarded in science and engineering—384,674 degrees out of 507,217 total science and engineering degrees (NSF 1999).

Historically, about one-third of all bachelor's degrees are earned in science and engineering fields. With only a few exceptions, the numbers of bachelor's degrees in both

science and engineering and in non-science and -engineering fields have been increasing since 1966. (See appendix table 2-4.)

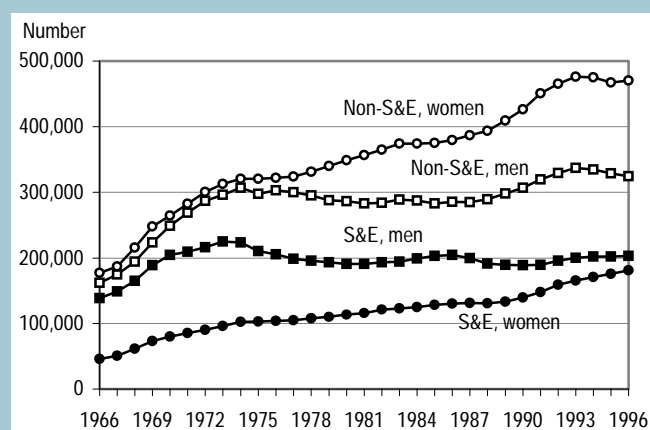
Women

The number of bachelor's degrees in science and engineering awarded to women has increased each year since 1966 (with the single exception of 1988), reaching 181,333 in 1996. (See appendix table 2-5.) The number of bachelor's degrees in science and engineering awarded to men has fluctuated around 200,000 since 1976. (See figure 2-2.) Women earn more bachelor's degrees in non-science and -engineering fields than do men. In fact, women have received more than half of all bachelor's degree awarded in non-science and -engineering fields since at least 1966 and 59 percent in 1996. (See appendix table 2-6.)

Women account for nearly half of all science and engineering bachelor's degree awards. The percentage of bachelor's degrees in science and engineering earned by women, which had held fairly constant in the early to mid-1980s at 38 to 39 percent, has been steadily increasing since then, and reached 47 percent in 1996. (See appendix table 2-6.)

Figure 2-2.

Bachelor's degrees awarded in science and engineering (S&E) fields and in non-S&E fields, by sex: 1966–96



SOURCE: Tabulations by National Science Foundation/Division of Science Resources Studies; data from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey.

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Women have received an increasing share of the bachelor's degrees awarded in all major science and engineering fields except mathematics and computer science. (See appendix table 2-6.) In engineering, for example, women earned less than 1 percent of the bachelor's degrees in 1966 but 18 percent in 1996. In mathematics, women have earned 46 to 47 percent of the bachelor's degrees awarded since 1985. In computer science, the proportion of female bachelor's degree recipients reached a high of 37 percent in 1984 and dropped to 28 percent in 1996. During the 1987–96 period, the number of bachelor's degrees in awarded computer science declined for both men and women. (See figure 2-3.)

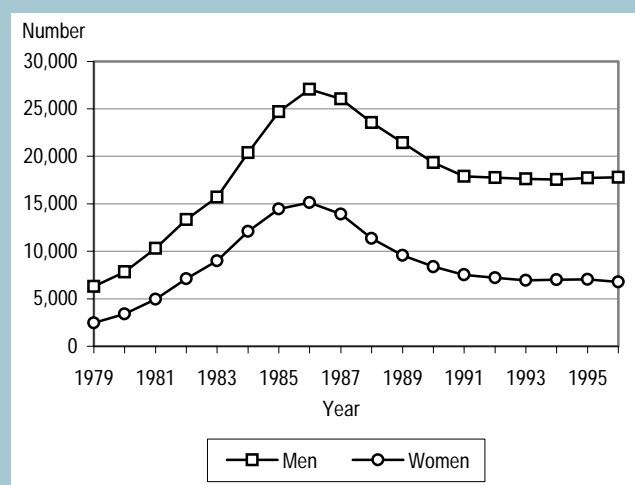
A dissimilarity index was constructed to measure the amount of similarity or dissimilarity in the distributions of men and women by bachelor's degree field.² In 1966, the dissimilarity index was 25.6, indicating that 25.6 percent of women would have to switch their bachelor's degree field in order to match the distribution of fields for male bachelor's degree recipients. By 1996, the dissimilarity index was 15.2. (See appendix table 2-6.)

In 1996, women earned nearly three-quarters of the bachelor's degrees awarded in psychology (73 percent), and over half of those in the biological sciences and in most social sciences. They earned 46 percent of the bachelor's degrees in mathematics, 43 percent in chemistry, and 40 percent in the agricultural sciences. Women earned approximately a third of the bachelor's degrees in astronomy (37 percent), earth sciences and ocean sciences (35 percent in each), economics (30 percent), computer science (28 percent), and chemical engineering (32 percent). On the other hand, women earned less than 20 percent of the bachelor's degrees awarded in aerospace engineering, electrical engineering, mechanical engineering, physics, and atmospheric sciences in 1996. (See appendix table 2-7.)

Minorities

The number of science and engineering bachelor's degrees earned by whites leveled off in the 1990s, and the number of non-science and -engineering bachelor's degrees earned by whites decreased from 1994 to 1996. (See appendix table 2-8.) In sharp contrast, the numbers of bachelor's degrees earned by Asians, blacks, Hispanics,

Figure 2-3.
Bachelor's degrees in computer science, by sex: 1979–96



SOURCE: Tabulations by National Science Foundation/Division of Science Resources Studies; data from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey.

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and American Indians in both science and engineering and non-science and -engineering fields increased each year from 1989 to 1996.

Blacks, Hispanics, and American Indians earn roughly the same percentages of science and engineering bachelor's degrees as of non-science and -engineering degrees. Blacks earned 7 and 8 percent of science and engineering and non-science and -engineering bachelor's degrees, respectively, in 1996. Hispanics earned 6 percent of both; American Indians earned 0.6 percent of both. Both the numbers and percentages of degrees in science and in engineering earned by nonwhite racial/ethnic groups have risen since 1989. (See figure 2-4 and appendix table 2-9.)

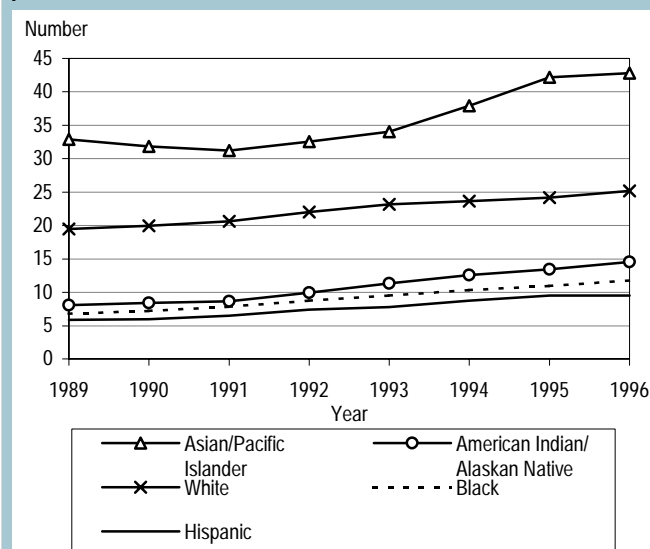
With the exception of Asians, for whom almost half of all bachelor's degrees received are in science and engineering, about one-third of bachelor's degrees earned by each racial/ethnic group are in science and engineering. (See text table 2-3.) The field distribution of these science and engineering bachelor's degrees differs by racial/ethnic group.

Blacks earned higher percentages of the bachelor's degrees awarded in the social sciences (especially sociology where they earned 15 percent of all bachelor's degrees), psychology, and computer science than they did of bachelor's degrees in other science and engineering

² The dissimilarity index is calculated as the sum of the absolute difference between the percentage of female bachelor's degree recipients earning degrees in each field and the percentage of male bachelor's degree recipients earning degrees in each field divided by 2.

Figure 2-4.

Bachelor's degrees in science and engineering per thousand 20- to 24-year-olds, by race/ethnicity of U.S. citizens and permanent residents: 1989-96



SOURCES: Tabulations by National Science Foundation/Division of Science Resources Studies; data from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System Completions Survey and U.S. Department of Commerce, Bureau of the Census, Current Population Survey.

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fields; they earned relatively lower percentages of agricultural science and engineering degrees. (See appendix tables 2-9 and 2-10.) The percentage of engineering bachelor's degrees earned by blacks rose from 3 percent in 1989 to 5 percent in 1996. The percentage of agricultural science bachelor's degrees earned by blacks remained at around 2 percent from 1989 to 1996. (See appendix tables 2-8 and 2-9.)

Asians earned higher percentages of the bachelor's degrees awarded in computer science, biological sciences (especially biochemistry and cell and molecular biology), and engineering (especially electrical engineering); they earned lower percentages of agricultural science, most social sciences, and psychology degrees. Their share of degrees in all of these fields, with the exception of the agricultural sciences, has been increasing since 1989. (See appendix table 2-9.)

Hispanics earned roughly 5 to 7 percent of bachelor's degrees in most science and engineering fields, but only 3 percent of bachelor's degrees in the agricultural sciences and 2 percent of bachelor's degrees in earth, atmospheric, and ocean sciences in 1996. They earned the highest percentage of degrees in microbiology (10 percent) and industrial engineering (10 percent). Their share of degrees in all major fields except biological sciences has been increasing since 1989. (See appendix table 2-9.)

Text table 2-3.

Percentage of all earned bachelor's degrees that are in science and engineering, by citizenship and race/ethnicity of recipient: 1989-96

Citizenship and race/ethnicity	1989	1990	1991	1992	1993	1994	1995	1996
Total, all recipients.....	32.8	32.6	32.2	32.8	32.9	33.4	34.0	34.4
U.S. citizens and permanent residents ¹	32.4	32.2	31.9	32.5	32.7	33.2	33.9	34.2
White, non-Hispanics.....	31.8	31.5	31.2	31.8	31.9	32.4	33.0	33.4
Asians/Pacific Islanders.....	50.9	51.1	49.3	48.6	48.4	48.3	49.1	49.2
Black, non-Hispanics.....	30.6	30.7	30.7	31.5	31.9	31.9	32.3	32.4
Hispanics.....	32.2	31.7	31.3	32.8	31.9	32.8	33.3	33.5
American Indians/Alaskan Natives.....	31.2	30.2	30.0	30.4	32.6	33.0	32.9	33.3
Other/unknown race/ethnicity.....	30.3	31.0	33.6	33.6	33.6	34.3	34.6	35.9
Nonresident aliens ²	46.6	46.4	42.9	42.9	42.6	40.7	39.9	39.3

¹ Racial/ethnic categories are as designated on the survey form. These categories include U.S. citizens and foreign citizens on permanent visas (i.e., resident aliens who have been admitted for permanent residency).

² Nonresident aliens include foreign citizens on temporary visas only. No racial/ethnic data are collected for this group.

NOTE: Data on race/ethnicity of degree recipients were collected on broad fields of study only until 1994; therefore, these trend data could not be adjusted to the exact field taxonomies used by NSF.

SOURCE: Tabulations by National Science Foundation/Division of Science Resources Studies; data from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey.

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American Indians earned between 0.4 and 0.8 percent of the bachelor's degrees awarded in the various science and engineering fields in 1996. They earned the highest percentages of degrees in the agricultural sciences (0.8 percent) and social sciences (0.7 percent). They earned the lowest percentages in mathematics, computer science, and engineering (0.4 percent of each). (See appendix table 2-9.)

A dissimilarity index was constructed to measure the amount of similarity or dissimilarity in the distributions of racial/ethnic groups by bachelor's degree field.³ The dissimilarity index is highest for Asians—17.5 percent of Asians would have to switch their bachelor's degree field to match the field distribution of white bachelor's degree recipients—but is decreasing over time. (See appendix table 2-8.) The index is lowest for Hispanics—1.8 percent would have to switch their bachelor's degree field to match the field distribution of white bachelor's degree recipients.

³ The dissimilarity index is calculated as the sum of the absolute difference between the percentage of degree recipients in a particular racial/ethnic group earning degrees in each field and the percentage of white degree recipients earning degrees in each field divided by 2.

Minority women

Within each racial/ethnic group in 1996, women represented a lower percentage of bachelor's degrees in science and engineering than in non-science and -engineering. In contrast to white and Asian women, however, black, Hispanic, and American Indian women earned more than half of the bachelor's degrees in science and engineering awarded to their respective racial/ethnic group in 1996. (See text table 2-4.)

Persons with disabilities

Data on participation of persons with disabilities in undergraduate and graduate education are seriously limited for several reasons:

1. Differing operational definitions of “disability” have been used; these include a wide range of physical and mental conditions. Different sets of data have used different definitions and thus are not comparable.
2. Data about disabilities are frequently not included in comprehensive institutional records. Concerns about confidentiality often inhibit collection or dissemination by institutions of data on disabilities.

Where Minorities Earn Their Degrees

Some colleges and universities educate a disproportionate share of undergraduates who are members of racial/ethnic minorities. For example, America's Historically Black Colleges and Universities (HBCUs) continue to play an important role in educating and producing black science and engineering bachelor's degree recipients. The percentage of blacks awarded bachelor's degrees in science and engineering in 1996 who earned them at HBCUs was 31 percent, up slightly from 28 percent in 1990. (See appendix table 2-11.) About two-thirds of the 25 institutions that awarded the largest number of science and engineering bachelor's degrees to black males and females were HBCUs. (See appendix table 2-12.)

Hispanics are likely to earn bachelor's degrees from colleges and universities in regions of the country where they are most concentrated: California, Texas, and Puerto Rico. (See appendix table 2-13.) Puerto Rico awarded 21 percent of the science and engineering bachelor's degrees received by Hispanics in 1990 and 15 percent in 1996. (See appendix table 2-14.)

Like Hispanics, American Indians earn bachelor's degrees from colleges and universities where their population is concentrated: California, Oklahoma, and Colorado. (See appendix table 2-15.) Almost all of the science and engineering bachelor's degrees awarded to American Indians come from non-Tribal colleges. Tribal colleges and universities (TCUs), first established in the late 1960s, are academic institutions created and chartered, for the most part, by one or more tribes (NCES 1998a). As of 1998, there were 30 TCUs which are located for the most part on Indian reservations. Only six TCUs are 4-year colleges or universities; the rest are 2-year schools. Of the six TCUs that offer bachelor's degrees, two offer bachelor's degrees in science and engineering—one offers courses of studies in social sciences, and the other in agricultural sciences. (See appendix table 2-16.) The number of American Indians being awarded both bachelor's and associate's degrees in science and engineering increased from 1990 to 1996. (See appendix tables 2-16 and 2-17.)

Text table 2-4.

Percentage of bachelor's degrees earned by women, by field and by race/ethnicity of U.S. citizens and permanent residents: 1996

Field	Total	White, non-Hispanic	Asian/ Pacific Islander	Black, non-Hispanic	Hispanic	American Indian/ Alaskan Native	Other/ unknown
Total, all fields.....	55.9	54.3	55.9	67.2	62.5	62.0	53.1
Total science and engineering.....	47.8	45.9	48.1	63.0	55.0	54.6	46.4
Engineering.....	18.3	16.3	21.2	36.4	22.8	21.7	15.9
Sciences.....	53.2	51.0	56.3	66.1	61.3	58.4	51.3
Physical sciences.....	36.2	33.1	42.6	57.1	44.0	26.0	28.5
Earth, atmospheric, and ocean sciences.....	36.2	36.0	30.6	46.0	44.1	37.0	33.9
Mathematical sciences.....	44.5	44.3	41.0	51.6	43.1	39.7	39.4
Computer science.....	27.4	22.8	31.8	47.9	34.9	35.5	25.8
Biological sciences.....	57.7	55.7	57.9	79.7	63.5	60.7	52.4
Agricultural sciences.....	44.4	43.3	60.3	66.9	57.8	46.8	41.8
Social sciences.....	48.2	45.5	56.9	60.7	55.9	54.8	50.8
Psychology.....	74.1	72.9	76.3	80.3	81.7	83.0	68.9
Non-science and -engineering.....	60.0	58.5	63.5	69.2	66.2	65.7	56.6

NOTE: Racial/ethnic categories are as designated on the survey form. These categories include U.S. citizens and foreign citizens on permanent visas (i.e., resident aliens who have been admitted for permanent residency).

SOURCE: Tabulations by National Science Foundation/Division of Science Resources Studies; data from U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey.

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- The information on persons with disabilities gathered from surveys is often self-reported. Typically, respondents are asked if they have a disability and to specify what kind of disability it is. The resulting data therefore reflect individual decisions to self-identify and not objective measures.

Although the National Science Foundation (NSF) collects data on the disability status of scientists and engineers in most of its surveys and uses common definitions among its surveys, these cover people who have earned at

least a bachelor's degree in science and engineering or who are employed in science and engineering. NSF does not collect data on individuals in precollege education or undergraduate education. The National Center for Education Statistics does collect data for those levels of education, but in many instances does not include measures of disability status. It has already been noted that colleges and universities do not maintain data in their central records that identify students with disabilities. Therefore, enrollment and degree data collected from colleges and universities are not reported by disability status.

Availability of Institutional Data on Students With Disabilities

To the extent that institutions maintain data on students with disabilities at all, they are only for those students who identify themselves to the institution as having a disability. The basis for identification is varied: 28 percent of the academic institutions surveyed in a recent study by the National Center for Education Statistics included students to whom services or accommodations were provided; 38 percent included students who provided verification of their disabilities, regardless of whether services or accommodations were provided; 22 percent included students who identified themselves to the disability services office or coordinator, regardless of verification or provision of services; and 12 percent included students who had been reported to the disability services office or coordinator, regardless of contact with them.

The majority of academic institutions do not maintain records of students with disabilities in their general student record system. About 70 percent of the institutions maintain records of students with disabilities in the disability support services office, and most of those maintain only paper records. About 9 percent of institutions maintain no records at all on students with disabilities. Only about one-fifth maintain records of students with disabilities in their general student record system and thus would easily be able to report data on students with disabilities through existing National Center for Education Statistics data collections, which rely on the general student record system (NCES 1999).

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